

**TANK CLEANING DEVICE**

**BACKGROUND OF THE INVENTION**

1. Field of the Invention

10        This invention relates to a cleaning device. More particularly, this invention relates to a device for use in cleaning of tanks and other storage containers.

2. Description of the Prior Art

15        Tank and other storage containers used for storing and transporting liquids usually can only be cleaned with extreme difficulty. As used herein, the term tanks shall include other storage containers. All the residue and sediment must be removed before the tank can be placed back into service. It has been  
20        customary to clean the interior of such tanks by alternately steaming and/or washing down the interior. In some cleaning operations, workmen must enter the tank to operate high pressure cleaning hoses. This type of cleaning operation is extremely hazardous to the workmen. It presents the possibility that workmen  
25        might be exposed to noxious, explosive or otherwise hazardous fumes generated by the residue and sediment in a tank to be cleaned.

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5 to be complex devices utilizing several nozzles or orifices for  
cleaning. This makes them costly to manufacture and difficult to  
manipulate. For example, U.S. Patent No. 1,838,643 to Peterson et  
al, describes a complex tank cleaning device which utilizes a  
hose connected to a rigid vertical pipe for the distribution of  
10 the cleaning fluid. The nozzle of the hose is fixed to a gear box  
at the end of the vertical pipe. The inclination of the nozzle  
may be changed by rotating a set of beveled gears. The entire  
apparatus must be rotated in discrete steps and supported by a  
framework which rests on the tank.

15 It would be an advantage to provide a device which does not  
require a supporting frame or complex construction and can be  
used effectively to clean all the interior surfaces of the tank  
without necessitating workmaen breaking the plane of entry into  
the tank.

20

#### **SUMMARY OF THE INVENTION**

It is an object of the invention to obviate the  
disadvantages of the prior art.

25 It is another object of the invention to provide a more  
mobile tank-cleaning device which does not require a support  
frame or complex construction.

5        It is a further object of the invention to provide a tank cleaning device which can direct a jet of cleaning fluid at all the interior surfaces of a tank to provide complete cleaning.

      In accordance with one aspect of the invention, there is provided a device for cleaning tanks comprising a hollow,  
10 continuous, rigid pipe having a straight portion and a curved portion, the straight portion having a connecting end for connecting to a source of cleaning fluid, the curved portion being substantially semicircular and having a nozzle end for emitting a stream of cleaning fluid.

15        In accordance with another aspect of the invention, there is provided a method for cleaning tanks wherein the method involves inserting a tank cleaning device into a tank, the tank cleaning device comprising a hollow, continuous, rigid pipe having a center axis, straight portion and a curved portion, the straight  
20 portion having a connecting end for connecting to a source of cleaning fluid, the curved portion being substantially semicircular and having a center point and a nozzle end; supplying a source of pressurized cleaning fluid to the tank cleaning device to cause a jet of cleaning fluid to be emitted  
25 from the nozzle end; and rotating the tank cleaning device about the center axis and the center point to cause the jet of cleaning fluid to impinge on an interior wall of the tank.

5 In accordance with still another aspect of the invention,  
there is provided a device for cleaning tanks comprising a  
flexable hose having a nozzle and connectable to a source of  
cleaning fluid, the flexible hose being disposed within a hollow,  
continuous, rigid pipe having a center axis, straight portion and  
10 a curved portion, the curved portion being substantially  
semicircular and having a center point, and an open end, the  
nozzle being disposed in the open end of the curved portion.

In accordance with a further aspect of the invention, there  
is provided a method for cleaning tanks wherein the method  
15 involves inserting a tank cleaning device into a tank, the tank  
cleaning device comprising a flexible hose having a nozzle and  
connectable to a source of cleaning fluid, the flexible hose  
being disposed in a hollow, continuous, rigid pipe having a center  
axis, straight portion and a curved portion, the curved portion  
20 being substantially semicircular and having a center point, and  
an open end, the nozzle being disposed in the open end of the  
curved portion; supplying a source of cleaning fluid to the hose  
to cause a jet of cleaning fluid to be emitted from the nozzle;  
and rotating the tank cleaning device about the center axis and  
25 the center point to cause the jet of cleaning fluid to impinge on  
an interior wall of the tank.

Other features and advantages of the invention will be  
apparent from the following description taken in connection with  
the accompanying drawings.

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is a view of the tank cleaning device of the present invention.

FIGS. 2-6 are vertical cutaway views of a tank illustrating the use of the tank-cleaning device therein.

FIGS. 7 & 8 are views of alternate nozzle end designs of the tank-cleaning device.

FIG. 9 is a view of another embodiment of the tank-cleaning device wherein a flexible hose is inserted in a preformed distributor.

**DESCRIPTION OF THE PREFERRED EMBODIMENT**

The present invention is a tank cleaning device which uses a continuous, curved, rigid distributor to emit a jet of cleaning fluid (i.e. water) from a nozzle connected to the end of the distributor. In another embodiment, a double braided hydraulic hose having a nozzle connected to its end is inserted into a preformed continuous, curved, rigid distributor to emit a cleaning fluid. The cleaning fluid may be steam or other suitable chemical cleaning fluid which is supplied to the distributor under pressure. The device has the ability to rotate freely around a center axis while permitting rapid and continuous adjustment of the inclination of the nozzle end with

5     respect to the horizontal plane of the tank. This allows a jet  
of cleaning fluid to be rapidly directed to reach all the inside  
walls of a tank for complete cleaning. The cleaning fluid  
containing the residual product and sediment is washed down to  
the bottom of the tank where it is drawn off. The use of the  
10    present invention yields a complete cleaning sufficient to  
permit the tank to be placed back into service. Tanks may be  
cleaned without necessitating the entrance of workmen into the  
tank or if desired the tank cleaning device permits a safer tank  
atmosphere to be obtained prior to workmen entering. Unlike  
15    other prior art devices, no supporting frame or complex  
mechanical devices are required to manipulate the nozzle.

Referring to FIG. 1, one embodiment of a tank cleaning  
device 10 is formed of a hollow, continuous, pipe 12 capable of  
containing a pressurized fluid. The pipe 12 is made of a rigid  
20    material such as a plastic, metal or fiberglass although other  
suitable materials that are presently used in the manufacture of  
pipes and which are sufficiently rigid may also be used. Pipe 12  
has a straight portion 34 and a curved portion 16. Straight  
portion 34 has a connecting end 14 for connecting to fluid  
25    supply coupling 20 which in turn is connected to a source or  
multiple sources of a pressurized cleaning fluid (not shown).  
Nozzle end 18 is attached to the curved portion 16 and opposite  
connecting end 14 for delivering a stream of fluid cleaning  
fluid to the tank walls. Nozzle end 18 may consist of a

5 connector and a detachable nozzle. Curved portion 16 is substantially semicircular to allow the tank cleaning device 10 to be at least partially inserted into the tank through the manhole opening and to permit rapid and continuous adjustment of the inclination of nozzle 18 by rotating curved portion 16 about  
10 center point 32. Tank cleaning is effectuated by rotating the device 10 about center axis 2 while changing the inclination of nozzle 18. In this manner, a forceful stream of cleaning fluid capable of reaching the upper and lower interior surfaces of the tank is delivered in a revolving fashion. A few of different  
15 cleaning movements that may be made by tank cleaning device 10 are illustrated in FIGS. 2-6.

In a preferred embodiment, the continuous hollow pipe 12 is made of a plastic material. Plastic is preferred because of its ability to be readily shaped into a sufficiently rigid form  
20 while still light and strong. Curved portion 16 has a radius 4 of about 15 inches. The radius 4 may vary depending on the size of the tank to be cleaned or the tank opening. For example, a greater radius may be needed for the cleaning of a larger tank and conversely a smaller radius for a smaller vessel. The pipe  
25 12 has an inside diameter of about 2 inches but may, depending on the size of the tank to be cleaned, be greater or lesser in diameter as necessary to facilitate the cleaning of different size tanks. The straight portion 34 of the pipe 12 has a connecting end 14 constructed so as to be connectable to a



5 standard hose or pressure hose coupling. The pressure from the  
presurized source may vary from 20 psi to a high pressure of  
4000 psi. For example, 20 psi normally is used to clean smaller  
tanks or drums. Variances may be made in the pressure depending  
on the container to be cleaned and the type of device needed for  
10 the pressure required. The straight portion 34 is normally about  
6 inches in length, but may vary in length depending on the size  
of the tank and the depth that the device has to be inserted  
therein. The nozzle end 18 is tapered to a diameter narrower  
than pipe 12 so as to produce a high velocity jet of fluid  
15 exiting therefrom. Nozzle end 18 may also be constructed to  
accept a detachable nozzle to vary the force pattern and  
quantity of the fluid exiting therefrom. Fluid supply coupling  
20 and connecting end 14 may be constructed to permit 360°  
rotation about center axis 2 without entangling the attached  
hose.

Another embodiment of the present invention, is shown in  
Fig. 9. A flexible hose 42 inserted within a preformed  
distributor 44 having the same shape as the hollow continuous  
pipe shown in Fig. 1.

25 Preferably, the flexible hose 42 is a double braided  
hydraulic hose. Preformed distributor 44, has a straight portion  
34 and a curved portion 16. Straight portion 34 is used for  
directing the device when it has been placed within a tank. The  
hose 42 has a connecting end 48 for connecting to a fluid supply

5 or to a source or multiple sources of a pressurized cleaning  
fluid (not shown). Nozzle 46 is attached to the end of the hose  
42 and opposite the connecting end 48 for delivering a stream of  
fluid cleaning fluid to the tank walls. Nozzle 46 is disposed in  
the open end 50 of the curved portion 16. Curved portion 16 is  
10 substantially semicircular to allow the tank cleaning device 10  
to be at least partially inserted into the tank through the  
manhole opening clean out or clean out pipe.

Preferably distributor 44 is made of an aluminum material.

15 Although a pressure of 3000 psi is the pressure most  
commonly used with the device for the cleaning of tanks, for  
more problematic cleaning the invention could receive and  
deliver cleaning fluid at 4000 psi or higher psi at varied  
quantities in various patterns by utilizing materials of  
different rigidity capable of withstanding higher pressure and  
20 heat requirements.

Alternative nozzle designs are shown in Figs. 7 & 8. In  
these embodiments, the nozzle end 18 is slightly curved in the  
direction opposite the curvature of the curved portion 16. A  
detachable nozzle 40 is attached to the nozzle end 18.

25 Referring to FIGS. 2-6, tank cleaning device 10 is shown  
inserted through the opening, or manhole, 36 in the top of tank  
22 to permit access to the interior of the tank. Near the bottom  
of interior wall 24 is an opening 30 for receiving a valve (not  
shown) whereby the contents of the tank 22 may be emptied. Device

5 10 delivers the pressurized cleaning fluid outwardly in a jet  
stream 7 to impinge against the inner wall surfaces 24 of the  
tank 22 in a pattern defined by the rotating of the curved  
portion 16 about its center point 32 and about its center axis 2.  
Because the device has the ability to move simultaneously in two  
10 different directions, it is possible to generate a sweeping  
action, e.g. moving the jet stream 7 from side to side or from  
top to bottom, to more quickly clean the interior surface of the  
tank thereby making the cleaning process more efficient and  
thorough. The force of the jet stream and action of the cleaning  
15 fluid dislodge the residual product and sediment from the wall  
24. The contaminated cleaning fluid is discharged through opening  
30 and collected for proper disposal.

While the invention has been described with regard to a  
specific embodiment thereof, it will be understood by those  
20 skilled in the art to which the invention pertains that numerous  
changes may be made in the invention without departing from the  
spirit or scope thereof.